

private landowners, and agency personnel. Rebuilding salmon runs in Butte Creek will require a negotiated balance among wildlife, agriculture, and fishery needs. Flow improvements can be gained by providing minimum flow requirements below diversions and acquiring existing water rights from willing sellers.

It is generally believed that gravel recruitment in the upper sections is not affected by existing diversion dam since they are either seasonal agricultural dams or relatively low-head hydropower dams which have not had major impacts on gravel recruitment of sediment supply. Existing gravel sources should be protected and supplemental gravel placed into the creek channel as needed.

The Butte Creek Watershed Conservancy is an important organization in developing, evaluating, and implementing measures to improve the ecological health of Butte Creek. This conservancy comprises local stakeholders who work closely with federal and State resource agencies to maintain and restore habitats along the creek. The Butte Creek Watershed Conservancy will be instrumental in developing a comprehensive watershed management plan. It will assist or sponsor some of the needed restoration elements in the basin, including improving streamflows for gravel recruitment and fish passage. The management plan will help to preserve and restore spring-run chinook salmon and steelhead trout. The ecological health of the creek also could be improved by developing and implementing a comprehensive watershed management plan. Current timber harvest in the upper watershed is generally not a threat to chinook salmon or steelhead holding and spawning areas. Maintaining the existing harvest and well-planned road construction will minimize any future effects. Additional recreation areas must be carefully planned and implemented to preserve existing fish habitat. Forest management, including reducing fire fuel loads, will protect riparian habitats and streamflows and help to prevent excessive sediment from being washed into the creek.

The riparian corridor needs to be protected and improved in the lower and upper river. In the lower river, riparian habitat improvements will be coordinated with flood control management activities in cooperation with local landowners.

Salmon and steelhead passage will be provided at diversion dams, including Western Canal, Durham Mutual, Adams, Gorrill, McGowan, and McPherrin. In some cases, dams will be removed. In others, fish ladders will be constructed or upgraded. Migration into lower Butte Creek via Butte Slough and the Sutter Bypass is the present means for salmon and steelhead passage to and from Butte Creek. Gates on the Sacramento River at the head of Butte Slough could be modified and operated to allow year-round passage of both juveniles and adult fish. There may also be improvements in the operation of weirs and diversions in the Sutter Bypass channels that will improve the survival of salmon and steelhead.

BUTTE SINK ECOLOGICAL MANAGEMENT UNIT

The Central Valley is one of the most important waterfowl wintering areas in the Pacific Flyway. In recognition of the value of waterfowl throughout North America, the Central Valley Habitat Joint Venture was formed to protect and restore wetlands in the Central Valley. The Butte Sink is one of the important elements of this venture. There are 11,363 acres of publicly owned and managed waterfowl habitat in the area, including the Butte Sink National Wildlife Refuge (733 acres), Gray Lodge Wildlife Area (8,375 acres), Upper Butte Sink unit of Gray Lodge (3,750 acres). The Gray Lodge WA is natural habitat in complex of wetlands and associated uplands whereas the Upper Butte Sink Unit and Butte Sink NWR are mostly agricultural land that will be restored to natural habitat. Hunting clubs maintain more than 30,000 acres of habitat in a normal year. Of this total, about 18,000 acres are natural wetlands and 12,000 acres are harvested rice fields flooded for hunting. Currently, 5,350 acres of private duck clubs are permanently protected by USFWS Conservation Easements in the Butte Basin. The National Audubon Society owns and manages another 500 acres of wetlands at the Paul L. Wattis Audubon Sanctuary west of Butte Creek (Central Valley Habitat Joint Venture 1990).

The area is also seasonally important for salmon and steelhead passage between the Sacramento River and holding, spawning, and rearing areas of the creeks. The sink is predominately wetlands interspersed with riparian vegetation all of which is subject to frequent natural seasonal flooding, which are major reasons for

its importance to fish and wildlife, particularly waterfowl.

VISION FOR THE ECOLOGICAL MANAGEMENT ZONE

The vision for the Butte Basin Ecological Management Zone includes restoring important fishery, wildlife, and plant communities to health. Generally, health will be attained when the status of specific biological resources is no longer a problem in the Delta. To attain this vision, this program will seek to improve streamflow and riparian corridors, screen diversions, remove barriers to fish migration, and restore watershed health through improved forest and rangeland management.

The vision for the Butte Basin Ecological Management Zone focuses on restoring physical processes and habitats and reducing stressors to meet spring-run chinook salmon and steelhead population levels of the late 1960s and early 1970s. In addition, improvements in the riparian corridors will provide improved habitat for waterfowl and other wildlife. The program proposes targets and actions that will increase protection for naturally produced chinook salmon and steelhead as they rear and migrate to the mainstem Sacramento River. Important actions to improve survival include maintaining and restoring a healthy riparian zone, which includes ample shaded riverine aquatic (SRA) habitat, woody debris, and biologically productive gravel beds for fish spawning and invertebrate production. The vision also anticipates screening many small water diversions and providing sufficient flows during important periods of adult migration and juvenile emigration.

The Ecosystem Restoration Program (ERP) recommends the following approaches for restoring the Butte Basin Ecological Management Zone.

VISIONS FOR ECOLOGICAL MANAGEMENT UNITS

PAYNES CREEK ECOLOGICAL MANAGEMENT UNIT

The vision for the Paynes Creek Ecological Unit is to improve steelhead trout and fall-run chinook salmon populations by improving streamflows and gravel spawning habitat. Paynes Creek can make minor but important contributions to the upper Sacramento

River runs of these fish if adequate holding, spawning, rearing, and migration habitat are provided. Adequate streamflows are important for maintaining and restoring the connectivity of upstream spawning and nursery areas with the mainstem Sacramento River. Sufficient flows must be provided to cleanse and distribute new spawning gravels. The riparian corridor needs significant improvement in several areas; some have been denuded and will require significant revegetation.

ANTELOPE CREEK ECOLOGICAL MANAGEMENT UNIT

The vision for the Antelope Creek Ecological Unit is to increase its ability to make small contributions to chinook salmon and steelhead populations by improving fall and spring flows, increasing spawning gravels and restoring riparian corridors. The health of Antelope Creek will be maintained so that it can provide seasonal inflow, sediments, and nutrients to the Sacramento River. Antelope Creek will provide important migratory corridors for aquatic and terrestrial species. Antelope Creek could be important in some years for salmon and steelhead with adequate flows and improved spawning and rearing habitat.

MILL CREEK ECOLOGICAL MANAGEMENT UNIT

Mill Creek is an important ecological unit in the Butte Basin Ecological Management Zone. It provides valuable habitat for anadromous and native resident fish. The vision for the Mill Creek Ecological Unit is to increase spring- and fall-run chinook salmon and steelhead by maintaining adequate streamflows, restoring riparian corridors, and maintaining upper watershed health. This could be accomplished by implementing a locally sponsored comprehensive watershed management and restoration program, and by implementing actions recommended for the Sacramento River, Delta, and Suisun Marsh ecological management zones. It is important to note that Mill Creek's undisturbed condition offers holding and spawning habitat which is essentially unchanged from historic times. Restoration of the creek's anadromous fish populations may depend on the success of downstream restoration actions.

DEER CREEK ECOLOGICAL MANAGEMENT UNIT

The Deer Creek Ecological Unit is one of the more important ecological units in the Butte Basin Ecological Management Zone. It provides for highly valued populations of spring-run chinook salmon and steelhead, and populations of other chinook salmon and resident native fish. The vision for Deer Creek is to increase chinook salmon and steelhead runs by maintaining adequate streamflows, spawning gravels, fish passage, protecting and restoring riparian corridors, and maintaining upper watershed health. This is being accomplished by a locally sponsored comprehensive watershed management and restoration program which is supported by many state and federal agencies.

DEER CREEK WATERSHED DEMONSTRATION PROGRAM: Deer Creek has been tentatively selected as a demonstration watershed for the CALFED Stage 1 (first seven years) Implementation Program. During Stage 1, CALFED will support ongoing management and restoration efforts in the watershed. Success in Stage 1 will set the stage for subsequent implementation phases as information derived in the Deer Creek watershed will have broad application in designing and implementing similar programs in other watersheds throughout the Sacramento Valley.

Cumulatively, an investment in Deer Creek during Stage 1 will provide direct benefits to the creek and provide the types of restoration information needed to successfully move the Ecosystem Restoration Program into subsequent implementation phases. A few of the lessons to be learned in the Deer Creek watershed include how to improve overall watershed health; how to integrate local, state, federal, and private efforts in a large-scale restoration program; how to design and implement actions to benefit spring-run chinook salmon and steelhead; and how to best manage ecological processes such as sediment transport and stream meander in a partially modified stream system.

One of the cornerstones to the probable success of this effort is the Deer Creek Watershed Conservancy. The Conservancy is an active organization comprised of landowners within the watershed who have joined together with state and federal resource management agencies to protect and restore the unique ecological

attributes of the watershed. Though a stakeholder planning process, the Conservancy has completed a watershed management plan including and existing conditions report and an important watershed management strategy which outlines actions to protect the future of Deer Creek.

BIG CHICO CREEK ECOLOGICAL MANAGEMENT UNIT

The vision for the Big Chico Creek Ecological Management Unit is to increase runs of chinook salmon and steelhead by providing adequate streamflows, providing unobstructed fish passage, protecting and restoring riparian corridors, and maintaining upper watershed health. This could be accomplished by implementing a locally sponsored comprehensive watershed management and restoration program.

BUTTE CREEK ECOLOGICAL MANAGEMENT UNIT

The vision for the Butte Creek Ecological Management Unit is restoring spring-run chinook salmon and steelhead populations by improving fish passage, increasing and improving streamflow, consolidating and screening diversions, and protecting and restoring the riparian corridor. These improvements will help to restore and maintain habitats needed to support a large population of spring-run chinook salmon and modest populations of fall-run chinook salmon and steelhead trout. Screening will allow continued water diversion for agricultural purposes and for the seasonal flooding of private wetlands and adjacent wildlife refuges. Restoring habitat in Butte Creek would allow the spring-run and fall-run chinook population to achieve increased annual spawning populations.

BUTTE SINK ECOLOGICAL MANAGEMENT UNIT

The vision for the Butte Sink Ecological Management Unit includes restoring stream channels, streamflow, and riparian SRA habitat, as well as adjacent wetland habitat. ERPP also envisions restoring or maintaining stream channels, streamflows, and SRA habitat to improve rearing and migrating conditions for salmon and steelhead and to improve habitats for resident native fishes, such as the Sacramento splittail.

VISIONS FOR ECOLOGICAL PROCESSES

CENTRAL VALLEY STREAMFLOW: Healthy streamflows are required to sustain sediment transport, stream meander, riparian plant communities and aquatic organisms. The vision is that streamflows will emulate (imitate) the natural seasonal runoff pattern. This would include a late-summer or early fall flow event to sustain ecological processes related to channel maintenance. Such flows would attract and improve the upstream migration of adult chinook salmon.

COARSE SEDIMENT SUPPLY: Natural sediment supplies and gravel recruitment below major dams have been eliminated. Supplementing gravel and other sediments at those sites and reactivating sediment transport in lower creek sections would assist in maintaining ecological processes and important habitat substrates used for invertebrate production and fish spawning. The vision is that existing natural sediment supplies will be protected to maintain stream channel gradients, provide gravel for spawning and invertebrate production, and contribute to maintaining riparian vegetation.

STREAM MEANDER: A natural stream meander process will provide much of the habitat needed to support healthy riparian systems, wildlife, and aquatic species. The vision is that streams will be allowed to naturally migrate consistent with flood control requirements.

VISIONS FOR HABITATS

SEASONAL WETLAND HABITAT: The vision is that increased seasonal flooding of leveed lands, use of the Butte Sinks's natural flood detention capacity, protection and enhancement of existing wetlands, and development of cooperative programs with local landowners will contribute to increased habitats for waterfowl and other wetland dependent fish and wildlife resources such as shorebird, wading birds, and the giant garter snake.

RIPARIAN AND RIVERINE AQUATIC HABITATS: Habitats important to anadromous fish production in this ecological zone are impaired by land use activities, including developments along the stream corridors. Improvements are needed to restore riparian, shaded riverine (of rivers) aquatic (SRA), and

woody debris habitats. These, in turn, will support improved aquatic species survival. The vision is that the riparian system will provide shading to moderate water temperatures, provide habitat for aquatic species, and provide a migration corridor for birds and other terrestrial species.

FRESH EMERGENT WETLAND HABITAT: The vision is to maintain and enhance existing permanent marshes in the Colusa Basin Ecological Management Zone.

FRESHWATER FISH HABITAT: Freshwater fish habitat is an important component needed to ensure the sustainability of resident native and anadromous fish species. The upper reaches of creeks in Butte Basin Ecological Management Zone are typical of salmon-steelhead streams and the lower section are typical of fall chinook salmon spawning stream (Moyle and Ellison 1991). The quality of freshwater fish habitat in these creeks will be maintained through actions directed at streamflows, coarse sediment supply, stream meander, natural floodplain and flood processes, and maintaining and restoring riparian and riverine aquatic habitats.

ESSENTIAL FISH HABITAT: The streams in this ecological management zone have been identified as Essential Fish Habitat (EFH) based on the definition of waters currently or historically accessible to salmon (National Marine Fisheries Service 1998). Key features of EFH to maintain or restore in these creeks include substrate composition; water quality; water quantity, depth and velocity; channel gradient and stability; food; cover and habitat complexity; space; access and passage; and flood plain and habitat connectivity.

AGRICULTURAL LANDS: Improving habitats on and adjacent to agricultural lands in the Butte Basin Ecological Management Zone will benefit native waterfowl and wildlife species. Emphasizing certain agricultural practices (e.g., winter flooding and harvesting methods that leave some grain in the fields) will also benefit many wildlife that seasonally use these important habitats.

VISIONS FOR REDUCING OR ELIMINATING STRESSORS

WATER DIVERSIONS: Removing water through unscreened diversions is a direct source of young fish

mortality. Reducing these losses would contribute to overall ecosystem health by promoting sustainable fisheries and higher population levels. The vision is that alternative water sources will reduce reliance on instream diversions and that water will be diverted in a manner that does not impair efforts to restore aquatic species and riparian habitat.

DAMS AND OTHER STRUCTURES: Improve the opportunity for the successful upstream and downstream migration of anadromous fish species. The vision is that instream structures will not impair the up- and downstream migration of aquatic species.

HARVEST OF FISH AND WILDLIFE: The legal and illegal harvest of chinook salmon and steelhead in the streams, Bay-Delta, and ocean constrain the recovery of wild populations. Harvest rate reductions will be necessary to allow recovery of populations. The vision is that harvest will not impair efforts to rebuild chinook salmon and steelhead populations.

ARTIFICIAL PROPAGATION OF FISH: The artificial production of chinook salmon and steelhead supports important sport and commercial fisheries and mitigates loss of salmon and steelhead habitat that resulted from dam construction. Due to release practices, fish from several Central Valley hatcheries supplement the naturally spawning salmon and steelhead in the Sacramento River and its tributaries. Hatchery salmon and steelhead may impede the recovery of wild populations by competing with wild stocks for resources. Hatchery-raised stocks, because of interbreeding, may not be genetically equivalent to wild stocks or may not have the instincts to survive in the wild. If these stocks breed with wild populations, overall genetic integrity suffers. Improvements in hatchery practices are necessary to ensure recovery of wild salmon and steelhead populations. The vision is that hatchery practices throughout the Sacramento Valley will not impair the genetic integrity or identity of chinook salmon and steelhead in the Butte Basin Ecological Management Zone.

VISIONS FOR SPECIES

FALL-RUN CHINOOK SALMON: The vision for fall-run chinook salmon is to recover all stocks presently proposed for listing under the ESA, achieve naturally spawning populations levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and the use fully existing and

restored habitat. Fall-run chinook will directly benefit from restoration actions to improve ecological processes and habitat, and by reducing stressors that reduce juvenile and adult fish survival. The vision is that fall-run chinook salmon will be sustained at levels that fully use existing and restored habitat.

SPRING-RUN CHINOOK SALMON: The vision for spring-run chinook salmon is to recover this State and federally listed threatened species, achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that fully use existing and restored habitats. Spring-run chinook will directly benefit from restoration actions to improve ecological processes and habitats, and by reducing stressors that reduce juvenile and adult fish survival. The vision is that adult and juvenile spring-run chinook salmon will fully use existing and restored habitat.

STEELHEAD: The vision for steelhead is to recover this federally listed threatened species and achieve naturally spawning populations of sufficient size to support inland recreational fishing and that use fully existing and restored habitats. Steelhead will directly benefit from restoration actions to improve ecological processes and habitats, and by reducing stressors that reduce juvenile and adult fish survival. The vision is that steelhead will fully use existing and restored habitat.

LAMPREY: The vision for anadromous lamprey is to maintain and restore population distribution and abundance to higher levels than at present. The vision is also to better understand life history and identify factors which influence abundance. Lamprey are a California species of special concern. Because of limited information regarding their status, distribution, and abundance, the vision is that additional monitoring or research will provide the data necessary to better manage these species and their habitat.

NATIVE ANURAN AMPHIBIANS: The vision for the native anuran amphibian species is to stop habitat loss and the introduction of other species that prey on the different life stages of these amphibians. Ongoing surveys to monitor known populations and find additional populations is essential to gauge the health of the species in this group. To stabilize and increase anuran populations, non-native predator species should be eliminated from historic habitat ranges.

Increasing suitable habitat and maintaining clean water supplies that meet the needs of the various species in this group is essential.

NATIVE RESIDENT FISH: The vision for native resident fish species is to maintain and restore by distribution and abundance of species such as hardhead, Sacramento sucker, and California roach.

NEOTROPICAL MIGRATORY BIRDS: The vision for neotropical migratory birds is to maintain and increase populations through restoring habitats on which they depend.

GIANT GARTER SNAKE: The vision for the giant garter snake is to contribute to the recovery of this State and federally listed threatened species in order to contribute to the overall species richness and diversity. Achieving this vision will reduce the conflict between protection for this species and other beneficial uses of land and water in the Bay-Delta. Protecting existing and restoring additional suitable wetland and upland habitats will be critical to achieving recovery of the giant garter snake. The proposed restoration of aquatic, wetland, riparian, and upland habitats in the Butte Basin Ecological Management Zone will help in the recovery of this species by increasing habitat quality and area.

WATERFOWL: The vision for waterfowl is to maintain and restore healthy populations at levels that can support consumptive (e.g., hunting) and nonconsumptive (e.g., birdwatching) uses consistent with the goals and objectives of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan. Many species of resident and migratory waterfowl will benefit from improved aquatic, wetland, riparian, and agricultural habitats. Increase use of the Butte Basin Ecological Management Zone, particularly in the Butte Sink Ecological Management Unit, and possibly increases in some populations would be expected.

GREATER SANDHILL CRANE: The vision for the greater sandhill crane is to contribute to the recovery of this State-listed threatened species. Improvements in pasture lands and seasonally flooded agricultural habitats, such as flooded corn fields, should help toward recovery of the greater sandhill crane population.

PLANT SPECIES AND COMMUNITIES: The vision for plant species and communities is to protect

and restore these resources in conjunction with efforts to protect and restore wetland and riparian and riverine aquatic habitats.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

WATERSHED ORGANIZATIONS MILL CREEK CONSERVANCY

The Mill Creek Conservancy is spearheading a cooperative approach to watershed management with special emphasis on protecting and enhancing chinook salmon and steelhead habitat. In December 1994, the Conservancy developed a Memorandum of Understanding (MOU) to create a Mill Creek Watershed Management Strategy. There are 17 partners to the MOU, including the U.S. Forest Service, California Department of Fish and Game (DFG), Bureau of Land Management, California Department of Water Resources (DWR), The Nature Conservancy, Natural Resource Conservation Service, Los Molinos School District, and others. In 1995, the Conservancy secured funding and developed a work program for a cooperative, local resource management approach. In 1996, a wide range of stakeholders participated in eight Scoping Study sessions to discuss goals and project priorities. The result was the *Mill Creek Watershed Management Strategy Report*, which contained 13 recommendations from the Watershed Advisory Committee. The USFWS, through the CVPIA, has provided funding for riparian restoration projects along lower Mill Creek. Planting and monitoring will be done over a three-year period.

DEER CREEK WATERSHED CONSERVANCY

The Deer Creek Watershed Conservancy was created by the property owners within the drainage to protect Deer Creek's unique ecological values. The Conservancy provides a forum for all stakeholders to become involved in the watershed and to share ideas regarding land use decisions. The processes used by the Conservancy helps build a common information base, keeps communication channels open, and establishes trust and credibility among those wishing to protect and enhance the watershed. The first act of this conservancy was to author and initiate legislation

to prevent the construction of any new dams within the watershed.

BUTTE CREEK WATERSHED CONSERVANCY

The Butte Creek Watershed Conservancy was formed to provide a forum for communication among stakeholders and property owners in the watershed and to develop a watershed planning and management program.

BIG CHICO CREEK WATERSHED ALLIANCE

The Big Chico Creek Watershed Alliance was sponsored by the City of Chico to address-specific problems in the watershed. Still active, it has the potential to serve as the public forum to bring together stakeholders, landowners, and technical experts to develop a watershed management program for Big Chico Creek.

FOUR PUMPS AGREEMENT

(Agreement Between the Department of Water Resources and the Department of Fish and Game to Offset Direct Fish Losses in Relation to the Harvey O. Banks Delta Pumping Plant.) This agreement between the Departments of Water Resources and Fish and Game is a mutually beneficial program to protect and restore habitat for anadromous fish, particularly for chinook salmon. Project-by-project funding is available through this agreement. Projects that provide quantifiable benefits to spring- and fall-run chinook salmon, within specified cost-benefit parameters, are generally approved for funding.

Maintaining and restoring the ecological health of the Butte Basin Ecological Management Zone units will heavily depend on local watershed groups. The ERPP encourages similar watershed groups on Paynes and Antelope Creeks. Efforts in the Butte Basin will be linked to the California Waterfowl Association, Ducks Unlimited, The Nature Conservancy, and the California rice industry. Overall efforts will require cooperation from resource agencies, such as DFG, DWR, U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS), as well as participation and support from the U.S. Bureau of Reclamation (Reclamation), the Natural Resources Conservation Service, and other private

organizations, water districts, and individual landowners. These groups are expected to work together to maintain and restore streamflows and fish and wildlife habitat, reduce impacts of diversions, and minimize poaching and habitat and water quality degradation in basin streams. ERPP may provide supporting funding for enhancing streamflows, reducing fish passage problems, screening diversions, restoring habitats, and increasing Fish and Game Code enforcement to protect recovering populations of salmon and steelhead.

CENTRAL VALLEY PROJECT IMPROVEMENT ACT

The U.S. Fish and Wildlife Service (USFWS) and the Bureau of Reclamation (Reclamation) are implementing the Central Valley Project Improvement Act (CVPIA), which provides for restoration of habitats and species and elimination of many stressors. Key elements of the CVPIA program include the Anadromous Fish Restoration Program (USFWS 1997) and the Anadromous Fish Screening Program. The CVPIA calls for doubling the salmon and steelhead populations in the Butte Basin by 2002.

SALMON, STEELHEAD AND ANADROMOUS FISHERIES PROGRAM ACT

Established in 1988 by Senate Bill 2261, this Act directs the DFG to implement measures to double the numbers of salmon and steelhead present in the Central Valley (CDFG 1993). The DFG's salmon and steelhead restoration program includes cooperative efforts with local governments and private landowners to identify problem areas and assist in obtaining funding for feasibility studies, environmental permitting, and project construction.

Other efforts to improve habitat and reduce stressors will be coordinated with existing state and federal programs and with stakeholder organizations. Their objectives include restoring Central Valley habitat and fish and wildlife populations.

CENTRAL VALLEY HABITAT JOINT VENTURE

The Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan have

developed objectives for wetlands in the Butte Basin Ecological Management Zone. These objectives are consistent with the ERPP targets developed for this Ecological Management Zone.

CALFED BAY-DELTA PROGRAM

CALFED has funded approximately 20 ecosystem restoration projects in Butte Basin. Many of these projects address improving fish passage and restoring riparian habitat. One of the more significant projects constructed a siphon to pass an irrigation canal under Butte Creek, removed five diversion dams, and eliminated 12 unscreened diversion for the Western Canal Irrigation District.

OTHER PROGRAMS —

- Lassen National Forest Land and Resource Management Plan.
- National Water Quality assessment Program-the Sacramento River Basin.
- Redding Resource Management Plan.
- Deer Creek Water Exchange Project.
- The Watershed Management Initiative.
- California Rivers Assessment (CARA).
- Rangeland Water Quality Management Plan.
- Sierra Nevada Ecosystem Project.
- Sacramento Coordinated Water Quality Monitoring Program.
- Sacramento River Toxic Pollutant Control Program.
- Sacramento River Watershed Program.
- Tehama County General Plan.
- Tehama County Groundwater Management Plan.

LINKAGE TO OTHER ECOLOGICAL MANAGEMENT ZONES

Many of the resource elements in the Butte Basin Ecological Management Zone depend heavily on conditions or elements in other zones. Anadromous fish, for example, are highly migratory and depend on conditions in the mainstem Sacramento River, Delta, San Francisco Bay, and nearshore Pacific Ocean. Because these fish are affected by stressors throughout their range, such as unscreened diversions, contaminants, water quality, harvest, and a variety of other factors, restoring anadromous fish

populations in the Butte Creek Ecological Management Zone will require efforts in other zones.

Reducing or eliminating stressors in the downstream Ecological Management Zones and improving or restoring downstream habitat are important to restoring healthy fish, wildlife, and plant communities in the Butte Basin Ecological Management Zone.

RESTORATION TARGETS AND PROGRAMMATIC ACTIONS

ECOLOGICAL PROCESSES

CENTRAL VALLEY STREAMFLOW

TARGET 1: Increase spring and fall flow in Paynes Creek (◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative approach to increase flow in Paynes Creek by acquiring water from willing sellers or by developing alternative supplies.

TARGET 2: Increase flow in Antelope Creek during October 1 through June 30 (◆).

PROGRAMMATIC ACTION 2A: Develop a cooperative approach to evaluate opportunities to increase flow in Antelope Creek. This involves acquiring water from willing sellers or providing alternative water supplies to diverters during the upstream and downstream migration of adult and juvenile spring- and fall-run chinook salmon and steelhead trout.

TARGET 3: Increase the flow in Mill Creek (◆).

PROGRAMMATIC ACTION 3A: Develop a cooperative approach to increase flow in the lower 8 miles of Mill Creek. This involves acquiring water from willing sellers or by providing alternative water supplies to diverters during the upstream migration of adult salmon and steelhead.

TARGET 4: Increase flow in the lower 10 miles of Deer Creek (◆).

PROGRAMMATIC ACTION 4A: Develop a cooperative approach to increase flow in the lower section of Deer Creek. This involves innovative means to provide alternative supplies during the upstream

migration of adult spring-run and fall-run chinook salmon and steelhead trout.

TARGET 5: Increase flow in Butte Creek (◆◆).

PROGRAMMATIC ACTION 5A: Develop a cooperative approach to increase flow in Butte Creek by acquiring water from willing sellers.

TARGET 6: Maintain a minimum year-round flow of 40 cfs in Butte Creek between the Centerville Diversion Dam and the Centerville Powerhouse (◆◆◆).

PROGRAMMATIC ACTION 6A: Develop a cooperative program with PG&E to maintain a minimum flow in Butte Creek below the Centerville Diversion Dam.

TARGET 7: Develop and implement comprehensive watershed management programs to protect water quality, increase summer base flows, and protect and restore other resources such as riparian vegetation (◆).

PROGRAMMATIC ACTION 7A: Support local groups in funding and developing watershed management plans including support for watershed coordinators.

RATIONALE: The streams in the Butte Basin Ecological Management Zone provide extremely valuable habitat for spring-run chinook salmon and steelhead trout. One of the key attributes of streamflow in this Ecological Management Zone is providing for successful upstream passage of adult fish. In addition, flow is the power that drives many ecological functions and processes linked to stream channel morphology, riparian communities, and fish habitat. Many of the diversions on these streams are for agricultural purposes, and alternative water supplies during important periods could permit flow to remain in the creek while alternative sources are provided. The lower watersheds of many of these streams are being subdivided, and additional demands are being placed on the limited water supplies and instream flows. Two important periods are during the upstream migration of adult spring-run chinook salmon and the downstream migration of yearling spring-run chinook salmon and steelhead, which typically occurs in late winter and early spring. Water diversions often shorten the migration season, when streamflows naturally decline. This is the period

when supplemental or alternative water supplies could be used best.

COARSE SEDIMENT SUPPLY

TARGET 1: Develop a cooperative program to replenish spawning gravel in Big Chico Creek. Especially target stream reaches that have been modified for flood control so that there is no net loss of sediments transported through the Sycamore, Lindo Channel, and Big Chico Creek split (◆◆).

PROGRAMMATIC ACTION 1A: Assist in the redesign and reconstruct the flood control box culvert structures on Big Chico Creek near the Five-Mile Recreation Area to allow natural downstream sediment transport.

TARGET 2: Develop a cooperative program to improve fall-run chinook salmon spawning habitat in the lower 8 miles of Mill Creek (◆).

PROGRAMMATIC ACTION 2A: Develop a cooperative program to improve chinook salmon spawning habitats in lower Mill Creek by reactivating and maintaining natural sediment transport processes.

TARGET 3: Improve spawning gravel and gravel availability in Butte Creek (◆◆).

PROGRAMMATIC ACTION 3A: Develop a cooperative program to improve spawning habitat in Butte Creek by maintaining natural sediment transport processes.

RATIONALE: Gravel transport and deposition processes in Butte Basin Ecological Management Zone streams are essential. These processes maintain spawning and rearing habitats of spring-run and fall-run chinook salmon, steelhead trout, and other native fishes. Opportunities to maintain and restore gravel recruitment are possible by manipulating natural processes and controlling or managing environmental stressors that adversely affect gravel recruitment.

STREAM MEANDER AND FLOODPLAIN

TARGET 1: Preserve or restore the 50- to 100-year floodplains along the lower reaches of streams in the Butte Basin Ecological Management Zone, and construct setback levees to reactivate channel meander in areas presently confined by levees (◆◆).

PROGRAMMATIC ACTION 1A: Cooperatively evaluate whether a more defined stream channel in the lower 10 miles of Antelope Creek would facilitate fish passage by minimizing water infiltration through the streambed and maintaining flow connection with the Sacramento River.

PROGRAMMATIC ACTION 1B: Cooperatively evaluate whether a more defined stream channel in the lower 10 miles of Deer Creek would facilitate stream meander, channel-floodplain interactions, gravel recruitment and transport, and riparian regeneration.

RATIONALE: Stream meander belts are the areas in which natural bank erosion and floodplain and sediment bar accretions occur along streams. Natural stream meander belts in alluvial areas of the Butte Basin Ecological Management Zone function dynamically. They transport and deposit sediments and provide transient habitats important to aquatic invertebrates and fish. They also provide and maintain surfaces that are colonized by natural vegetation that supports wildlife. The lower valley stream reaches in this Ecological Management Zone serve as important migratory corridors to the upper watersheds for spring-run chinook salmon and steelhead and provide spawning substrate for fall-run chinook salmon.

HABITATS

SEASONAL WETLANDS

TARGET 1: Assist in protecting 10,000 acres of existing seasonal wetland habitat through fee acquisition or perpetual easements consistent with the goals of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan (◆◆).

PROGRAMMATIC ACTION 1A: Develop and implement a cooperative program to improve management of 10,000 acres of existing, degraded seasonal wetland habitat.

TARGET 2: Develop and implement a cooperative program to enhance 26,150 acres of existing public and private seasonal wetland habitat consistent with the goals of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan (◆◆).

PROGRAMMATIC ACTION 2A: Restore and manage seasonal wetland habitat throughout the Ecological Management Zone.

RATIONALE: Restoring seasonal wetland habitats along with aquatic, permanent wetland, and riparian habitats is an essential element of the restoration strategy for the Butte Basin Ecological Management Zone. Restoring these habitats will also reduce the amount and concentrations of contaminants that could interfere with restoring the ecological health of the aquatic ecosystem. Seasonal wetlands support a high production rate of primary and secondary food species and large blooms (dense populations) of aquatic invertebrates.

Wetlands that are dry in summer are also efficient sinks for the transformation of nutrients and the breakdown of pesticides and other contaminants. The roughness of seasonal wetland vegetation filters and traps sediment and organic particulates. Water flowing out from seasonal wetlands is typically high in foodweb prey species concentrations and fine particulate organic matter that feed many Delta aquatic and semiaquatic fish and wildlife. To capitalize on these functions, most of the seasonal wetlands of the Butte Basin Ecological Management Zone should be subject to periodic flooding and overland flow from river floodplains.

RIPIARIAN AND RIVERINE AQUATIC HABITATS

TARGET 1: Develop a cooperative program to restore and maintain riparian habitat along the lower 10 miles of Mill Creek (◆◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to restore and maintain riparian habitat along Mill Creek by acquiring conservation easements or by voluntary landowner participation.

TARGET 2: Develop a cooperative program to restore and maintain riparian habitat along the lower 10 miles of Deer Creek (◆◆◆).

PROGRAMMATIC ACTION 2A: Develop a cooperative program to restore and maintain riparian habitat along Deer Creek by acquiring conservation easements or by voluntary landowner participation.